TOOL 6. COSTS AND BENEFITS OF TYPICAL DIVERSION PROGRAMS

INTRODUCTION

Diversion of solid waste from disposal can be accomplished by either reducing waste generation—referred to by various terms including waste reduction, waste prevention and source reduction—or by recycling and composting. All of these techniques are used in some areas. In addition, disposing of wastes through incineration is sometimes used to further reduce the need for landfilling.

• Waste reduction efforts at the local level are largely confined to individual household practices.

The benefits and costs of waste/source reduction, recycling and composting programs are examined here. Emphasis is placed on MSW recycling and yard trimmings composting programs that are typically used in communities. Waste reduction efforts at the local level are largely confined to individual household practices and are more difficult to quantify. The most effective household waste reduction practice in diverting waste from disposal is management of yard trimmings at home.

• Waste reduction efforts at individual households are difficult to quantify.

BENEFITS OF DIVERSION PROGRAMS

Diversion from Disposal

Diverting wastes from disposal occurs in the management of nearly all solid wastes of concern. A large fraction of manufacturing wastes are recycled, as are construction and demolition (C&D) wastes, old vehicles, trees and brush from clearing work, etc. Of greatest concern to most municipalities is diversion of MSW, which is usually the dominant waste stream in municipal landfills.

• The most effective household waste reduction practice is management of yard trimmings at home.

Estimates of potential diversion of MSW through recovery for recycling and composting in communities typical of those in Wyoming is shown in Table 6-1. The recovery programs

shown are commonly used and can be established in most communities. Both residential and non-residential recovery programs are included. Ranges of recovery are shown for each program except yard trimmings composting. Yard trimmings are assumed to be separate from other MSW such that virtually all yard trimmings can be collected separately. While shown under residential recovery, some yard trimmings are generated from non-residential areas as well.

Total MSW recovery for recycling and composting with use of all the programs listed in Table 6-1 is shown between 25 and 41 percent of generation. Residential recovery accounts for two-thirds of the total, non-residential recovery one-third. A large part of the potential residential recovery is yard trimmings composting, which could be much less in communities with low quantities of collected yard wastes. However, managing yard trimmings at home—waste reduction—is just as effective in diverting them from disposal.

• A large part of the potential residential recovery is yard trimmings composting.

Curbside recycling recovery can vary widely, as shown, depending on what materials are collected and the percentage of households that participate in the program. Drop-off center recovery of recyclables is generally not as effective as curbside recycling, but would be much higher than shown in Table 6-1 if used by both single-family and multi-family households. Highest participation levels in both curbside recycling and drop-off programs are usually achieved when accompanied by volume/weight based fees on waste collected for disposal. Participation in curbside recycling of about 90 percent of households served has been achieved in some communities that have these unit-based fees on disposed household waste.

• Curbside recycling recovery can vary widely, as shown, depending on what materials are collected and the percentage of households that participate in the program.

• Drop-off center recovery of recyclables is generally not as effective as curbside recycling.

Recycling of waste paper grades from businesses is a long established practice and is heavily influenced by market prices for these materials. Nationally, over half of old corrugated containers (OCC) have been recovered in recent years and

Table 6-1
ESTIMATED POTENTIAL MSW RECOVERY FROM TYPICAL PROGRAMS IN WYOMING NON-MSA(1)

	% of MSW
Residential	
Curbside Recycling at Single Family Households (2)	4.5 to 14.5
Drop-off Center for Multi-family Households (3)	0.1 to 0.9
Yard Trimmings Composting (4)	≤12.6
Subtotal Residential Recovery	17.2 to 28.0
Non-Residential	
Office Paper Recovery (5)	1.0 to 1.7
Old Corrugated Container Recovery (5)	5.6 to 9.4
Major Appliances, Vehicle Batteries (6)	1.5 to 1.9
Subtotal Non-Residential Recovery	8.1 to 13.0
Total MSW Recovery	25.3 to 41.0

(1) Assumes MSW generation at 3.5 pounds/person/day.
(2) Low number assumes recovery of ONP and containers at 50% household participation; High number also assumes recovery of mixed paper and 90% household participation.
(3) Low number assumes recovery of ONP and containers from multi-family households of which10% participate: High number also assumes recovery of mixed paper with 50% of multi-family households participating.
(4) Assumes all single-family household yard trimmings collected separately for composting.
(5) Assumes national recovery level (as percent of MSW generation) plus/minus 25%.
(6) Assumes national recovery levels (as percent of MSW generation) with plus/minus 25% assumed for major appliances.

Source: Franklin Associates, Ltd.

most communities (even in rural areas) have recovery occurring in the business sector.

- **Most communities have recovery occurring in the business sector.**

The estimates shown in Table 6-1 for diverting MSW from disposal through recycling/composting should serve only as a guide to the potential for diversion with the programs shown. Not all programs in specific communities, however, will necessarily result in diversion levels within the ranges shown in Table 6-1.

Resource and Environmental Savings

Savings in both natural resources and the environmental are realized with recycling and waste reduction activities. In addition to the reduction in land used for landfilling and virgin raw materials used in manufactured products, energy savings are realized as well. The energy savings are beneficial in two ways by: 1) reducing the use of fuel and 2) reducing the emission of the "greenhouse" gas carbon dioxide (CO_2).

- **Savings in both natural resources and the environmental are realized with recycling and waste reduction activities.**

Energy usage with and without curbside recycling and yard waste composting programs are quantified in Tool 9. In general, one ton of recyclables collected through a typical curbside recycling program will result in a net energy savings of about 15 million BTUs as compared to landfilling. The energy savings are realized from the increased use of recovered materials in the manufacturing step. Both mining and manufacturing energy requirements are generally less when using recovered materials instead of virgin raw materials. Yard trimmings composting programs do not result in energy savings unless, perhaps, the compost can be substituted for fertilizer or other soil conditioning products.

- **The energy savings are realized from the increased use of recovered materials in the manufacturing step.**

Environmental benefits are realized from both recycling and composting. Reduced landfilling reduces the potential for ground and surface water pollution as well as emissions of methane (CH_4) and carbon dioxide. While carbon dioxide is still produced with composting, methane

generation—considered several times more detrimental as a greenhouse gas than carbon dioxide—is largely avoided. Reduced energy requirements with recycling also lowers emissions of carbon dioxide, as previously noted.

One of the difficulties in comparing waste diversion programs with disposal is assessing the value of the resource and environmental savings that accrue with diversion. It has, historically, been difficult to assign tangible values to the depletion of natural resources and damage to the environment.

- **It is difficult to assess the value of the resource and environmental savings that accrue with diversion.**

COSTS OF DIVERSION PROGRAMS

Cost Overview

Assessing the costs of waste/source reduction measures that may be taken at the local level is difficult. Local businesses may implement such measures only if they can be shown as cost effective—i.e., having no negative effect on earnings. This may not be true at households if a reduction measure is judged beneficial in preserving natural resources and the environment. Some waste reduction measures, such as leaving grass clippings on the lawn, may clearly save on household costs whereas, with others, the cost effects may be more difficult to determine.

- **Assessing the costs of waste/source reduction measures that may be taken at the local level is difficult.**

The costs of recycling (including composting) programs can normally be measured even if the value of the resulting resource and environmental savings cannot. Businesses normally engage in recycling practices, again, only if they are demonstrated as cost effective. This has driven recovery of OCC and office paper from businesses for many years.

- **The costs of recycling programs can normally be measured even if the value of the resulting resource and environmental savings cannot.**

Residential recycling programs, however, cannot always be demonstrated as cost effective and frequently add to out-of-pocket costs for SWM. This is often the case for both curbside recycling

and household yard waste composting programs. Drop-off and buy-back centers may be more cost effective if it can be assumed that trips to these centers and volunteer labor do not constitute costs.

The costs of curbside recycling and yard waste composting programs are a function of the costs of collecting and processing the materials and their market value. The net costs of these programs (after revenues from selling the recovered materials) are compared to the cost savings from reduced refuse collection and disposal to determine cost effectiveness. The comparison will show whether a specific program adds to or reduces total SWM costs.

- **The net costs of recovery programs are compared to the cost savings from reduced refuse collection and disposal to determine cost effectiveness.**

Typically, both curbside recycling and yard waste composting programs increase costs for managing household MSW. Table 6-2 includes estimates of monthly increases in household costs judged typical of those experienced with these programs in communities below 25,000 population. Each program is shown to add over $1.00 per household per month assuming market prices typical of those experienced in early 1996. On average, the increased costs shown equate to $112 per ton for recovered recyclables and $60 per ton for yard waste composted.

- **Typically, both curbside recycling and yard waste composting programs increase costs for managing household MSW.**

Table 6-2
ESTIMATED COST EFFECTS FROM
CURBSIDE RECYCLING & YARD TRIMMING COMPOSTING
IN HYPOTHETICAL COMMUNITY UNDER 25,000 POPULATION

	Increase in Household SWM Cost ($/month)
Curbside Recycling Program (1)(2)	1.10 to 1.85
Yard Trimmings Composting Program (3)	1.00 to 1.60

(1) Assumes once per week separate collection of ONP, metal cans, glass bottles and jars, PET soft drink bottles, and HDPE natural and pigmented containers. Costs shown allocated to all households receiving curbside recycling service including non-participating households.
(2) Reflects average price for recyclables at approximately $60 per ton.
(3) Assumes once per week separate collection of household yard trimmings and no revenue from sale of compost. Costs shown allocated to all households receiving the service including those not generating yard trimmings for collection.

Source: Table 4-5, Tool 4.

While the costs shown in Table 6-2 are judged as typical, site specific conditions and other factors have a bearing on actual costs for these programs in a given community. Factors influencing the cost effectiveness of household recycling programs include the following:

- market prices for recovered recyclables
- frequency of recyclables collection
- household participation
- types and quantities of recyclables collected
- disposal costs
- refuse collection and transportation costs
- labor costs.

•Site specific conditions have a bearing on actual costs for programs in a given community.

One of these factors—reducing the frequency of recyclables collection—can be used to improve the cost effectiveness of curbside recycling although sometimes at the expense of household participation. Collection of recyclables is the most costly part of curbside recycling. Thus, collection of more materials per stop reduces the costs of the program.

•Reducing the frequency of recyclables collection can improve the cost effectiveness of curbside recycling although sometimes at the expense of household participation.

Capital Costs

Initial capital investments needed to implement residential recycling or composting programs can vary substantially depending upon the type of program (e.g., curbside recycling versus drop-off) and the population included. Yard waste composting programs may involve fewer new collection vehicles than curbside recycling because the same trucks used to collect refuse can collect yard trimmings. Also, existing equipment such as front-end loaders, if available, may be used at composting operations thereby reducing the investment in new equipment.

•Initial capital investments needed to implement residential recycling or composting programs can vary substantially.

Curbside recycling programs may be expected to involve significant capital costs. This is

particularly true if new facilities to process the recyclables must be provided. Initial capital investment costs in collection vehicles and recyclables processing facilities may be approximated for small communities/population bases through use of Table 6-3. Capital cost ranges are estimated—in dollars per household served—for recyclables collection vehicles and processing facility needs. Processing facility capital costs are much higher than collection costs and this difference is greater in small communities.

• Processing facility capital costs are much higher than collection costs and this difference is greater in small communities.

Using Table 6-3 as a guide, a community of about 25,000 might be expected to incur total initial capital costs (for curbside recycling) of approximately 0.5 million dollars. This assumes the high end of the range shown in Table 6-3 for collection costs and the low end of the range shown for processing costs. A community of 10,000 might expect initial capital requirements at around 0.25 million dollars assuming the low end of the range shown for collection costs and the high end for processing costs. (Both of these estimates assume that 90 percent of the population are in households with separate collection service and that an average of 2.9 persons are in each of these households.)

• Drop-of recycling service would require much less capital investment.

Drop-off recycling service would require much less capital investment. In some small communities, nothing more than a trailer with enclosed compartments and a pickup truck to pull the trailer may be needed. Collected materials would need to be taken to a processing facility located elsewhere. Total costs for a suitable trailer and pickup should be no more than $25,000.

Table 6-3
ESTIMATED CAPITAL COSTS FOR
CURBSIDE RECYCLING PROGRAM
IN HYPOTHETICAL COMMUNITY UNDER 25,000 POPULATION

	Initial Capital Cost ($/single family household)(1)
Collection of Recyclable Materials (2)	13.00 to 19.00
Processing of Recyclable Materials (3)	48.00 to 68.00
	61.00 to 87.00

(1) For all households receiving separate collection service; usually includes dwellings with up to four household units.
(2) Low end of range assumes pickup truck with 16 cubic yard trailer with compartments; High end of range assumes 21 cubic yard recyclables collection truck with side loading automated-lift hopper.
(3) Assumes enclosed facility with baler, magnetic separator, glass crusher, front-end loader and forklift.

Source: Franklin Associates, Ltd.